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EFFECT OF ACCELERATED AGEING ON GERMINATION AND SEEDLING VIGOUR OF MANUALLY AND MECHANICALLY HARVESTED AND THRESHED RICE SEEDS

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ABSTRACT

The study was conducted at Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during kharif 2016 to find out the effect of accelerated ageing on germination, seedling vigour and biochemical constituents of manually and mechanically harvested and threshed rice varieties viz., CR1009 Sub 1, improved white ponni and CO51. The germination, seedling vigour, dehydrogenase and alpha amylase activity was high in fresh seeds compared to aged seeds in all the varieties in different methods of harvesting and threshing at different intervals after accelerated ageing. Among the varieties CR1009 Sub 1 recorded the maximum germination, seedling vigour and biochemical constituents followed by CO51, while improved white ponni recorded minimum. Among the treatments manual harvesting and threshing registered the maximum germination and seedling vigour followed by combine harvesting, the minimum was recorded in manual harvesting and mechanical threshing. The electrical conductivity of seed leachates gradually increased by the period of accelerated aging and was high in 20 days of ageing in all the varieties. The increase in EC was more in CR1009 Sub 1 (109.6 μSm^{-1}), followed by CO51 (95.3 μSm^{-1}) and improved white ponni (93.3 μSm^{-1}).

KEYWORDS: Rice, Accelerated Ageing, Seed Germination & Seedling Vigor

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Original Article

INTRODUCTION

Rice is an important global food crop and provides food security for many countries. As the world's population continues to grow to 10 billion by 2050, the demand for rice will grow faster than for other crops because population growth is greatest in the rice-consuming and rice-producing regions of Asia, Africa, and the America (Dawe, 2007; Easterling *et al*., 2007). India has the largest area under rice in the world and ranks second in the production after China. India has also emerged as a major rice consumer. In India, rice is cultivated in an area 43.95 Mha, producing 106.54 MT at a productivity of 2424 kg/ha. In Tamil Nadu rice area 1.79 Mha, production 5.54 MT and productivity 3700 kg/ha (India stat, 2016). Seed quality is the most important factor influencing crop growth, development, and yield processes. Harvesting, threshing and cleaning play a significant role in realizing the full benefit of raising crop by reducing post-harvest losses as well as improving quality of rice. These operations play a vital role in protecting seed viability/germination. Improper harvesting, threshing and cleaning may cause loss of seed germination/viability. Before recommending the best adoptable harvesting and threshing methods, we need to understand their effect on seed quality *viz.*, germination percentage and seedling vigor *etc.*

The accelerated aging test is a stress test. The seeds are stressed prior to the germination test. Seeds are placed in temperature of 40±1^{o}C and nearly 100% relative humidity for varying lengths of time, depending on the kind of seeds, after which a germination test is made. The basis for this test is that higher vigor seeds tolerate the high temperature-high humidity treatment and thus retain their capability to produce normal seedlings in the germination test. It was first developed by Delouche (1965) quoted in AOSA (1983) for seed longevity. Since then several researchers have carried out and aging treatment has been recommended for a wide range of crop species (AOSA, 1983). Accelerated ageing test has good correlation to field emergence and storage potential of the seed. In order to evaluate the storage potential of different varieties, accelerated ageing test is being employed in different crops. A uniform accelerated ageing procedure has not been developed for testing rice (*Oryza sativa* L.) seed obtained from different harvesting and threshing methods. The duration of accelerated ageing, the time taken to reduce the germination potential to 50% of the initial, varies with manually and mechanically harvested and threshed rice varieties. The results obtained from this test may be correlated with natural ageing/storage. In this context, an attempt was made to study the effect of accelerated aging on germination, seedling vigor and biochemical constituents of manually and mechanically harvested and threshed rice varieties.

MATERIALS AND METHODS

An experiment was conducted at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu during *kharif*, 2016 to find out influence of accelerated ageing on germination, seedlings vigor and biochemical changes of seeds obtained from the following harvesting and threshing methods in three different rice varieties of CR1009 Sub1, IW Ponni and CO51 at physiological maturity stage with a moisture content of 22.5%, 19.45% and 18.60% respectively. The treatments are manual harvesting and manual threshing (T_1), manual harvesting and mechanical threshing (axial flow thresher) (T_2) and combine harvester (with pneumatic wheel) (T_3). The harvested and threshed seeds were sun dried to reduce the seed moisture to 12 percent and processed using a cleaner cum grader. Twenty five grams of processed seeds were covered with a butter paper cover and placed in the desiccators. The desiccators were placed in an accelerated aging chamber maintained at 40^{o} C and 100% relative humidity at specified intervals (0, 1, 2, 3, 4, 5, 6, 7, 8, 9,10, 11, 12, 13, 14,15,16,17,18,19 and 20 days) during the accelerated ageing process. Treatment wise seeds were soaked in double of its volume in water for 16 hours and analyzed electrical conductivity. Dehydrogenase activity and Alpha-amylase enzyme activity were also estimated treatment wise. The accelerated aged and control seeds were then placed for germination in roll towel method. The experiment was conducted in a factorial completely randomized block design. Under each treatment, 400 seeds were sown with eight replications of 50 seeds each. Seed germination was expressed as the percentage of seeds producing normal seedlings. Fourteen days after sowing (ISTA, 2011) ten seedlings from each replication were randomly selected and the root and shoot lengths were measured and the mean was recorded. Ten random seedlings were dried in a hot air oven at 85^{0}C for 24 hours. And the dry weight was recorded and expressed as g/10 seedling. The vigor index was calculated using the following formula (Abdul – Baki and Anderson, 1973)

Vigor Index = Percentage germination x Total seedling length (cm).

The results were subjected to statistical analysis for significant difference (p=0.05) as per Panse and Sukhatme (1995). Percentage values were transformed using arc sine values prior to statistical analysis.

RESULTS AND DISCUSSIONS

Significant changes in seed germination were observed due to duration of accelerated ageing, treatments and varieties. The seed germinates in fresh seeds (95%) declined gradually to increase in ageing duration and reached the minimum at 20 days of accelerated aging (19%) (Table 1, Figure 1). Among the treatments, manual harvesting and threshing registered the maximum seed germination (64%) followed by combine harvester (61%), the minimum germination of 57 per cent registered in manual harvesting and mechanical threshing. Among the varieties, CR1009 Sub 1 recorded the maximum germination (66%) while improved white ponni recorded the minimum germination (53%). There was a significant progressive reduction in germination percent with increase in duration of accelerated ageing in rice genotypes by Somasundaram and Bhaskaran (2017). Vijayakumar and Vijayakumar (2015) in soybean and Kanakadurga *et al.* (2012) in pigean pea. Accelerated aging is a physiological stress test that permits controlled deterioration of seeds due to exposure of seeds to high temperature and high relative humidity (greater than 90%). Seed moisture content and high temperature influence seed metabolism. High relative humidity increases seed moisture, which results in biochemical events such as increased hydrolytic enzyme activity and free fatty acids where as high temperature serves to enhance the rate at which many enzymatic and metabolic reactions occurs and thereby increases the metabolic activity of hydrolyzed substrates and enzymes causing more rapid rate of deterioration (Khan *et al*., 2010). Further, during seed deterioration, the free radicals generated as a result of lipid peroxidation cause damage to enzymes that are necessary to convert reserve food in the embryo to a usable form and thereby affects production of normal seedling (Iqbal *et al.,* 2002) and these free radicals also degrade mitochondrial membrane leading to reduction in energy supply necessary for germination thereby cause failure in seed germination (Gidrol *et al.,* 1998).

Root length and shoot length were significantly influenced by accelerating ageing duration, treatments and varieties (Table 2 and 3). The root length of varieties before accelerating ageing ranged from 23.5 cm (CO51) to 23.9 cm (CR1009 Sub 1) where as shoot length ranged from 10.6 cm (improved white ponni) to 11.4 cm (CR1009 Sub 1). Root length and shoot length were significantly decreased after each period of accelerated ageing. But the rate of reduction did not vary significantly among the varieties. Among the treatments, manual harvesting and threshing registered the longest root length (17.1 cm) while manual harvesting and mechanical threshing registered the shortest root length (15.3 cm). Among the varieties, CR1009 Sub 1 recorded the longest root length (17.8 cm) while improved white ponni recorded the shortest root length (14.1 cm). Regarding shoot length manual harvesting and threshing registered the longest shoot (8.0 cm) while manual harvesting and mechanical threshing registered the shortest shoot (6.8 cm). Among the varieties, CR1009 Sub 1 recorded the longest shoot (8.6 cm) while improved white ponni recorded the shortest shoot (6.1 cm). The findings of this study are consistent with the findings of Rame Gowda (1992) in rice, Nautilyl *et al.* (1997) in peanut, Kanakadurga *et al.* (2012) in Pigeon pea and Rajendraprasad (2014) in sunnhemp. Reduced seedling growth due to accelerated ageing is mainly due to both lower respiration and reduced mitochondria in cells (McDonald, 1999).

Dry matter production and vigor index were significantly influenced by accelerating ageing duration, treatments and varieties (Table 4 and 5, Figure 1). The dry matter production before accelerating ageing ranged from 0.112 g/10 seedlings (Improved white ponni) to 0.147 g/10 seedlings (CR1009 Sub 1). Dry matter production decreased significantly over the duration of accelerated ageing. Among the treatments, manual harvesting and threshing registered the maximum dry matter (0.121 g/10 seedling) while the minimum was recorded in manual harvesting and mechanical threshing (0.115 g/10 seedling). Among the varieties, CR1009 Sub 1 recorded the maximum dry matter (0.143 g/10 seedling) and the

minimum was (0.096 g/10 seedling) observed in an improved white ponni. However, dry matter production ceased in improved white ponni which was harvested manually and threshed mechanically from 18 days of accelerated ageing. Reduction in dry matter production due to accelerated aging test is mainly because of poor seedling development (Mosavi*et al.,* 2011). Among the treatments, manual harvesting and threshing registered the highest vigor index (1757) while manual harvesting and mechanical threshing registered the lowest vigour index (1465). Among the varieties, CR1009 Sub 1 recorded the highest vigor index (1851) while improved white ponni recorded the lowest vigour index (1343). Reduced capacity to germinate and produce vigorous seedlings is the main reason for decreased vigor index due to accelerated ageing of seed (Singh, 1989). Similar conclusion on growth efficiency and seedling vigor as a result of ageing effects with regard to varietal responses was also reported by several workers (Kalpana and Rao, 1995; Gowda *et al.,* 2002; Kapoor *et al.,* 2010)

Electrical conductivity of seed leachates was significantly influenced by duration of accelerated ageing, seed treatments and varieties (Table 6). Irrespective of the treatment and varieties, the lowest electrical conductivity was observed in unaged seeds (60.1 μSm^{-1}) and increased gradually with increase in duration of accelerated ageing and reached the maximum at 20 days of ageing (143.7 μSm^{-1}). Among the treatment, manual harvesting and threshing registered the lowest electrical conductivity (96.1 μSm^{-1}) while the highest was recorded in manual harvesting and mechanical threshing (102.4 μSm^{-1}). Among the varieties, improved white ponni recorded the lowest electrical conductivity (93. μSm^{-1}) and the highest was observed in CR1009 Sub 1 (109.6 4 μSm^{-1}). Electrical conductivity of seed leachate is a good index of seed deterioration. Intensity of membrane damage during storage was measured by electrical conductivity of the seed leachate (Mathews and Bradnock, 1968). Parrish and Leopold (1978) determined that free radicals, which are very harmful to living cells, are produced in cell membranes when exposed to accelerated ageing, and may cause membrane damage resulting in ion leakage (as determined *via* electrical conductivity).

Among the accelerated ageing duration, dehydrogenase and alpha amylase activity declined to increase with the ageing duration and reached the minimum at 20 days of accelerated ageing (Table 7 and 8). Among the varieties, CR1009 Sub 1 recorded the maximum dehydrogenase activity (0.891) while the minimum was observed in improved white ponni (0.776). Kranshook *et al*. (1978) expressed that the loss in viability in rice seed was accompanied by changes in lipid and protein complexes in seed cells and associated decrease in energy potential which depended on changes in dehydrogenases, oxidases and the enzymes participating in respiration. Regarding alpha amylase activity, among the treatments, manual harvesting and threshing recorded the maximum activity (1.567) while the minimum was observed in manual harvesting and mechanical threshing (1.493). Among the varieties, CR1009 Sub 1 registered the maximum α-amylase activity (1.641) while the minimum was recorded in CO51 (1.460). Rame Gowda (1992) reported a decrease in the activity of enzymes *viz.*, α-amylase, catalyze and peroxides, coupled with progressive ageing of rice seeds.

In general, mechanical injury during harvesting, threshing, cleaning, handling and plating is considered as one of the most important factors influencing seed quality and thus seeds and seedling vigor. In the present study irrespective of the variety studied manual harvesting and mechanical threshing registered reduced germination, seedling vigor and biochemical constituents when compared to manual harvesting and manual threshing and combine harvesting. This may be due to at the time of threshing, increased cylinder speeds of thresher cause mechanical damage, especially ruptures which caused restriction of nutrient translocation to the embryonic axis caused seed and seedling abnormalities.

CONCLUSIONS

Accelerated ageing on germination, seedling vigor and biochemical constituents of manually and mechanically harvested and threshed rice varieties revealed that their ability to germinate and produce vigor's seedlings which are mainly due to varied resistance to deteriorative changes. Seed germination per cent in CO51 and CR1009 Sub 1 reduced to around 50 per cent of their initial by 14 days of accelerated ageing, where as improved white ponni reduced to around 50 per cent of their initial by 11 days of accelerated ageing. Hence 15 days of accelerated ageing is considered as optimum duration of ageing for manually and mechanically harvested rice varieties.

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APPENDICES

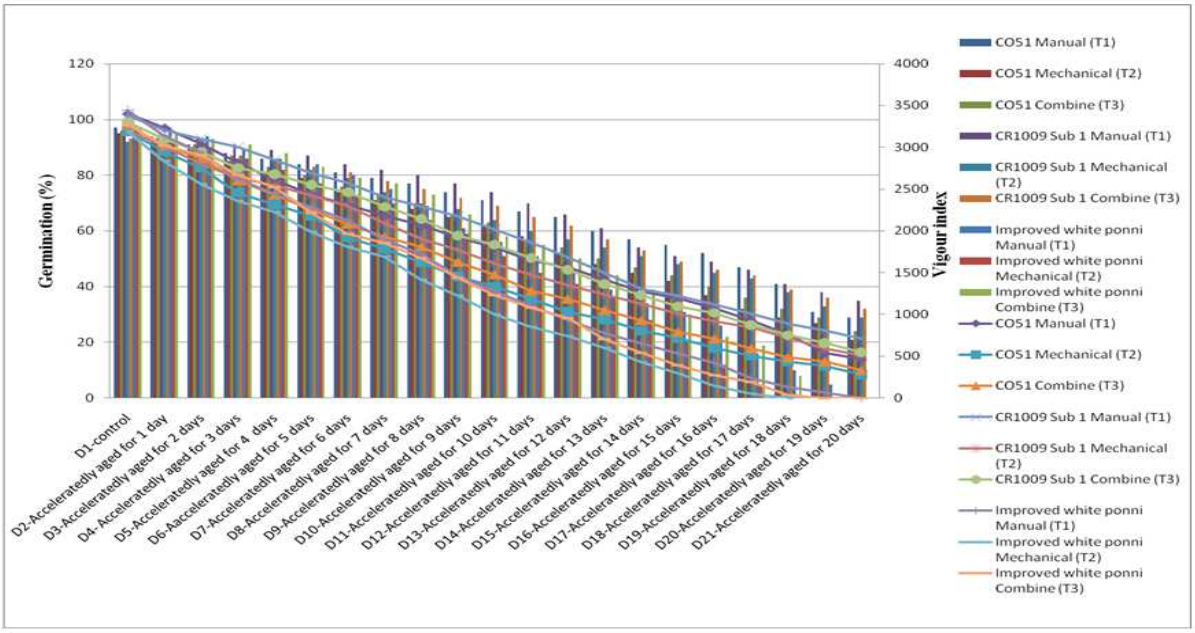

Figure 1: Effect of Accelerated Ageing on Germination (%) and Vigour Index of Manually and Mechanically Harvested and Threshed Rice Varieties

Table 1: Effect of Accelerated Ageing on Germination (%) of Manually and Mechanically Harvested and Threshed Rice Varieties

Accelerated Ageing in Days (D)	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1	97 (80.64)	95 (77.24)	96 (79.41)	**96 (79.41)**	95 (78.19)	92 (75.44)	93 (75.06)	**93 (75.06)**	98 (82.80)	96 (79.41)	97 (80.63)	**97 (80.63)**	**95 (77.24)**
D_2	94 (76.96)	93 (76.23)	94 (76.96)	**94 (76.96)**	94 (76.02)	90 (72.05)	92 (75.44)	**92 (75.44)**	97 (80.63)	92 (74.10)	95 (77.24)	**95 (77.24)**	**93 (75.06)**
D_3	91 (72.88)	89 (70.69)	91 (72.88)	**90 (72.05)**	93 (75.06)	88 (70.48)	90 (72.05)	**90 (72.05)**	94 (76.96)	89 (70.83)	93 (76.27)	**92 (75.44)**	**91 (72.88)**
D_4	88 (70.47)	85 (67.59)	87 (69.25)	**87 (69.25)**	91 (72.88)	86 (69.04)	87 (69.52)	**88 (70.47)**	89 (70.69)	86 (68.69)	91 (72.88)	**89 (70.69)**	**88 (70.47)**
D_5	86 (68.29)	81 (64.24)	83 (65.76)	**83 (65.76)**	89 (70.83)	85 (67.81)	86 (68.56)	**87 (69.25)**	86 (68.29)	82 (65.33)	88 (70.47)	**85 (67.81)**	**85 (67.81)**
D_6	84 (66.77)	79 (62.97)	80 (63.63)	**81 (64.75)**	87 (69.25)	82 (65.33)	83 (66.12)	**84 (66.77)**	84 (66.77)	77 (61.51)	83 (65.76)	**81 (64.75)**	**82 (65.33)**
D_7	81 (64.23)	74 (59.57)	76 (61.01)	**77 (61.51)**	84 (67.25)	79 (62.84)	81 (64.75)	**81 (64.75)**	80 (63.63)	73 (58.82)	79 (62.97)	**77 (61.51)**	**79 (62.97)**
D_8	79 (62.97)	71 (57.51)	73 (58.82)	**74 (59.43)**	82 (65.37)	74 (59.43)	78 (62.44)	**78 (62.44)**	75 (60.26)	70 (57.00)	77 (61.52)	**74 (59.43)**	**75 (60.40)**
D_9	77 (61.52)	68 (55.57)	70 (57.00)	**72 (58.35)**	80 (63.72)	70 (56.85)	75 (60.40)	**75 (60.40)**	69 (56.37)	64 (53.21)	73 (58.98)	**69 (56.37)**	**72 (58.35)**
D_{10}	74 (59.57)	65 (53.75)	66 (54.34)	**68 (55.57)**	77 (61.69)	68 (55.80)	72 (58.35)	**72 (58.35)**	61 (51.40)	59 (50.21)	66 (54.50)	**62 (52.03)**	**68 (55.57)**
D_{11}	71 (57.51)	62 (52.03)	63 (52.68)	**65 (53.75)**	74 (59.57)	64 (53.25)	69 (56.37)	**69 (56.37)**	56 (48.50)	51 (45.58)	58 (49.66)	**55 (47.88)**	**63 (52.68)**
D_{12}	67 (54.97)	58 (49.62)	56 (48.46)	**60 (50.80)**	70 (56.95)	60 (50.80)	65 (53.91)	**65 (53.75)**	51 (45.58)	45 (42.08)	55 (47.88)	**50 (45.00)**	**59 (50.02)**
D_{13}	65 (53.75)	52 (46.16)	54 (47.31)	**57 (49.05)**	66 (54.45)	57 (49.08)	62 (52.03)	**62 (52.03)**	46 (42.68)	41 (39.71)	50 (45.02)	**46 (42.68)**	**55 (47.88)**
D_{14}	60 (50.82)	48 (43.85)	50 (45.00)	**53 (46.75)**	61 (51.48)	54 (47.31)	57 (49.08)	**57 (49.05)**	39 (38.61)	36 (36.81)	44 (41.53)	**40 (39.21)**	**50 (45.00)**
D_{15}	57 (49.04)	45 (42.12)	47 (43.27)	**50 (45.00)**	54 (47.31)	51 (45.56)	53 (46.75)	**53 (46.75)**	34 (35.55)	28 (31.77)	39 (38.60)	**34 (35.55)**	**45 (42.12)**
D_{16}	55 (47.17)	42 (40.39)	44 (41.54)	**47 (43.27)**	51 (45.58)	48 (43.85)	49 (44.40)	**49 (44.40)**	31 (33.65)	20 (26.22)	30 (33.15)	**27 (31.18)**	**41 (39.80)**
D_{17}	52 (46.17)	37 (37.45)	40 (39.21)	**43 (40.92)**	49 (44.40)	45 (42.12)	46 (42.68)	**47 (43.27)**	26 (30.49)	12 (20.14)	22 (27.41)	**20 (26.01)**	**37 (36.67)**
D_{18}	47 (43.27)	32 (34.43)	36 (36.86)	**38 (38.03)**	46 (42.65)	43 (40.92)	44 (41.53)	**44 (41.53)**	16 (23.06)	5 10.61)	19 (25.59)	**13 (19.75)**	**32 (34.43)**
D_{19}	41 (39.76)	29 (32.55)	32 (34.40)	**34 (35.55)**	41 (39.80)	38 (38.03)	39 (38.57)	**39 (38.57)**	10 (18.35)	0 (2.87)	8 (15.90)	**6 (12.37)**	**26 (30.49)**
D_{20}	31 (33.76)	27 (31.18)	29 (32.49)	**29 (32.49)**	38 (37.95)	33 (34.93)	36 (36.72)	**36 (36.72)**	5 (11.82)	0 (2.87)	0 (2.87)	**2 (5.85)**	**22 (28.91)**
D_{21}	29 (32.49)	21 (27.20)	24 (29.30)	**25 (29.66)**	35 (36.09)	29 (32.31)	32 (34.27)	**32 (34.22)**	0 (2.87)	0 (2.87)	0 (2.87)	**0 (2.87)**	**19 (22.25)**
Mean	**68 (56.91)**	**60 (51.54)**	**61 (52.77)**	**63 (52.68)**	**69 (57.93)**	**64 (53.94)**	**66 (55.67)**	**66 (55.67)**	**55 (47.88)**	**49 (48.50)**	**56 (48.50)**	**53 (46.75)**	**61 (52.77)**
	T1	**64 (53.94)**		**T2**	**57 (49.05)**		**T3**	**61 (52.77)**					

	V	T	D	VT	TD	VD	VTD
SEd	0.5760	0.5760	1.5240	0.9977	2.6396	2.6396	4.5719
CD (P=0.05)	1.1363	1.1363	4.0063	1.9681	NS	NS	NS

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester
Figures in parenthesis indicate arcsine value

Table 2: Effect of Accelerated Ageing on Root Length (cm) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1-control	24.1	22.9	23.4	**23.5**	24.1	23.6	24.1	**23.9**	23.8	23.0	23.5	**23.4**	**23.6**
D_2-Acceleratedly aged for 1 day	23.9	21.7	22.0	**22.5**	23.2	22.5	22.8	**22.8**	22.1	21.1	22.0	**21.7**	**22.4**
D_3-Acceleratedly aged for 2 days	23.1	21.5	21.8	**22.1**	22.8	21.9	21.9	**22.2**	21.3	19.7	21.6	**20.9**	**21.7**
D_4- Acceleratedly aged for 3 days	22.3	20.2	21.1	**21.2**	22.5	20.7	21.5	**21.6**	20.0	18.8	20.3	**19.7**	**20.8**
D_5-Acceleratedly aged for 4 days	21.2	19.9	20.4	**20.5**	21.9	20.5	21.2	**21.2**	19.3	18.6	19.7	**19.2**	**20.3**
D_6-Aaccleratedly aged for 5 days	20.2	19.2	19.7	**19.7**	21.1	20.4	21.0	**20.8**	18.4	17.8	18.2	**18.1**	**19.6**
D_7-Acceleratedly aged for 6 days	19.7	18.1	19.1	**19.0**	20.7	20.0	20.8	**20.5**	18.2	17.0	17.0	**17.4**	**19.0**
D_8-Acceleratedly aged for 7 days	18.9	17.3	18.3	**18.2**	20.0	19.4	19.8	**19.7**	17.8	16.8	16.6	**17.1**	**18.3**
D_9-Acceleratedly aged for 8 days	18.4	16.3	17.9	**17.5**	19.3	18.7	19.2	**19.1**	17.1	15.4	16.1	**16.2**	**17.6**
D_{10}-Acceleratedly aged for 9 days	17.8	15.2	16.9	**16.6**	18.9	17.8	18.0	**18.2**	16.4	14.6	15.6	**15.5**	**16.8**
D_{11}-Acceleratedly aged for 10 days	17.1	14.7	16.1	**16.0**	18.2	17.1	17.9	**17.7**	15.9	14.2	15.4	**15.2**	**16.3**
D_{12}-Acceleratedly aged for 11 days	16.5	14.0	15.6	**15.4**	17.6	16.7	17.2	**17.2**	15.3	13.9	14.3	**14.5**	**15.7**
D_{13}-Acceleratedly aged for 12 days	16.3	13.8	15.4	**15.2**	17.0	16.1	16.7	**16.6**	14.0	13.0	13.7	**13.6**	**15.1**
D_{14}-Acceleratedly aged for 13 days	15.8	13.6	14.8	**14.7**	16.6	15.4	16.0	**16.0**	14.2	12.2	11.6	**12.7**	**14.5**
D_{15}-Acceleratedly aged for 14 days	15.0	12.4	13.9	**13.8**	16.2	15.1	15.7	**15.7**	13.4	11.5	10.0	**11.6**	**13.7**
D_{16}-Acceleratedly aged for 15 days	14.7	12.0	12.8	**13.2**	15.8	14.2	15.4	**15.1**	12.6	11.1	9.1	**10.9**	**13.1**
D_{17}-Acceleratedly aged for 16 days	13.6	11.3	12.5	**12.5**	15.0	13.7	14.9	**14.5**	11.6	9.3	8.8	**9.9**	**12.3**
D_{18}-Acceleratedly aged for 17 days	13.1	10.9	11.5	**11.8**	14.4	13.5	14.1	**14.0**	10.7	7.3	7.3	**8.4**	**11.4**
D_{19}-Acceleratedly aged for 18 days	12.3	10.3	10.3	**11.0**	14.2	12.6	13.1	**13.3**	9.0	0.0	4.4	**4.5**	**9.6**
D_{20}-Acceleratedly aged for 19 days	11.0	9.7	9.9	**10.2**	13.9	11.9	12.3	**12.7**	8.4	0.0	0.0	**2.8**	**8.6**
D_{21}-Acceleratedly aged for 20 days	10.3	9.0	9.3	**9.5**	13.0	11.3	11.1	**11.8**	0.0	0.0	0.0	**2.5**	**7.9**
Mean	**17.4**	**15.4**	**16.3**	**16.4**	**18.4**	**17.3**	**17.8**	**17.8**	**15.6**	**13.1**	**13.6**	**14.1**	**16.1**
	T1	**17.1**		**T2**	**15.3**		**T3**	**15.9**					

	V	T	D	VT	TD	VD	VTD
SEd	0.1489	0.1489	0.3940	0.2580	0.6825	0.6825	1.1821
CD (P=0.05)	0.2925	0.2925	0.7740	0.5067	1.3405	1.3405	2.3219

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 3: Effect of Accelerated Ageing on Shoot Length (cm) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	Mean
D_1-control	11.0	10.7	10.7	**10.8**	11.6	11.3	11.4	**11.4**	11.4	10	10	**10.6**	**11.0**
D_2-Acceleratedly aged for 1 day	10.5	10.1	10.2	**10.3**	11	10.9	10.9	**10.9**	10.3	9.7	9.8	**9.9**	**10.4**
D_3-Acceleratedly aged for 2 days	10.3	9.5	9.8	**9.9**	10.6	10.1	10.8	**10.5**	10.0	9.1	9.6	**9.6**	**10.0**
D_4- Acceleratedly aged for 3 days	9.7	8.8	9.1	**9.2**	10.5	9.9	10.1	**10.2**	9.5	8.8	9.1	**9.1**	**9.5**
D_5-Acceleratedly aged for 4 days	9.1	8.6	8.9	**8.9**	10.1	9.5	9.9	**9.8**	9.1	8.5	8.9	**8.8**	**9.2**
D_6-Aacceleratedly aged for 5 days	8.8	8.4	8.4	**8.5**	9.9	9.3	9.7	**9.6**	8.8	8.1	8.6	**8.5**	**8.9**
D_7-Acceleratedly aged for 6 days	8.8	7.9	8.2	**8.3**	9.8	9.1	9.6	**9.5**	8.5	7.8	8.0	**8.1**	**8.6**
D_8-Acceleratedly aged for 7 days	8.7	7.9	8.2	**8.3**	9.5	8.9	9.4	**9.3**	7.8	7.3	7.5	**7.5**	**8.4**
D_9-Acceleratedly aged for 8 days	8.3	7.5	8.0	**7.9**	9.3	8.6	9.3	**9.1**	7.9	6.7	6.8	**7.1**	**8.0**
D_{10}-Acceleratedly aged for 9 days	8.2	7.3	7.9	**7.8**	9.3	8.2	9.0	**8.8**	7.6	6.0	6.6	**6.7**	**7.8**
D_{11}-Acceleratedly aged for 10 days	8.2	6.7	7.4	**7.4**	9	8.2	8.7	**8.6**	6.9	5.4	5.8	**6.0**	**7.4**
D_{12}-Acceleratedly aged for 11 days	8.0	6.5	7.3	**7.3**	8.9	8.1	8.5	**8.5**	6.4	5.1	5.5	**5.7**	**7.1**
D_{13}-Acceleratedly aged for 12 days	7.9	6.0	6.6	**6.8**	8.6	7.6	8.0	**8.1**	6.2	4.6	5.1	**5.3**	**6.7**
D_{14}-Acceleratedly aged for 13 days	7.8	5.9	6.2	**6.6**	8.3	7.4	7.9	**7.9**	5.9	4.2	4.5	**4.9**	**6.5**
D_{15}-Acceleratedly aged for 14 days	7.3	5.5	5.9	**6.2**	8.1	7.2	7.4	**7.6**	5.7	3.7	4.0	**4.5**	**6.1**
D_{16}-Acceleratedly aged for 15 days	7.1	5.0	5.4	**5.8**	8.0	6.9	7.0	**7.3**	4.5	3.4	3.9	**3.9**	**5.7**
D_{17}-Acceleratedly aged for 16 days	6.9	4.9	5.3	**5.7**	7.9	6.5	6.9	**7.1**	4.4	2.9	3.4	**3.6**	**5.5**
D_{18}-Acceleratedly aged for 17 days	6.5	4.8	5.0	**5.4**	7.4	6.4	6.7	**6.8**	4.2	2.7	3.1	**3.3**	**5.2**
D_{19}-Acceleratedly aged for 18 days	6.1	4.7	4.9	**5.2**	7.3	6.2	6.1	**6.5**	4.1	0.0	2.3	**2.1**	**4.6**
D_{20}-Acceleratedly aged for 19 days	6.1	4.4	4.8	**5.1**	7.1	5.9	5.9	**6.3**	3.9	0.0	0.0	**1.3**	**4.2**
D_{21}-Acceleratedly aged for 20 days	5.7	4.2	4.5	**4.8**	6.9	5.6	5.7	**6.1**	0.0	0.0	0.0	**1.3**	**4.0**
Mean	**8.1**	**6.9**	**7.3**	**7.4**	**9.0**	**8.2**	**8.5**	**8.6**	**7.0**	**5.4**	**5.8**	**6.1**	**7.4**
	T1	**8.0**		**T2**	**6.8**		**T3**	**7.2**					

	V	T	D	VT	TD	VD	VTD
SEd	0.085	0.085	0.224	0.147	0.388	0.388	0.672
CD (P=0.05)	0.166	0.166	0.44	0.288	0.762	0.762	1.319

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 4: Effect of Accelerated Ageing on Dry Matter Production (g / 10 Seedlings) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	Mean
D_1-control	0.121	0.120	0.120	**0.120**	0.151	0.141	0.149	**0.147**	0.111	0.114	0.112	**0.112**	**0.127**
D_2-Acceleratedly aged for 1 day	0.121	0.114	0.119	**0.118**	0.166	0.149	0.160	**0.158**	0.117	0.111	0.116	**0.115**	**0.130**
D_3-Acceleratedly aged for 2 days	0.111	0.117	0.118	**0.115**	0.142	0.147	0.139	**0.143**	0.111	0.117	0.118	**0.115**	**0.124**
D_4- Acceleratedly aged for 3 days	0.115	0.117	0.116	**0.116**	0.157	0.147	0.155	**0.153**	0.107	0.113	0.111	**0.110**	**0.126**
D_5-Acceleratedly aged for 4 days	0.122	0.116	0.113	**0.117**	0.154	0.146	0.141	**0.147**	0.115	0.111	0.113	**0.113**	**0.126**
D_6-Aacceleratedly aged for 5 days	0.111	0.118	0.115	**0.115**	0.154	0.142	0.147	**0.148**	0.110	0.114	0.117	**0.114**	**0.125**
D_7-Acceleratedly aged for 6 days	0.119	0.113	0.123	**0.118**	0.161	0.153	0.157	**0.157**	0.112	0.115	0.114	**0.114**	**0.130**
D_8-Acceleratedly aged for 7 days	0.117	0.116	0.116	**0.116**	0.161	0.154	0.161	**0.159**	0.115	0.114	0.113	**0.114**	**0.130**
D_9-Acceleratedly aged for 8 days	0.112	0.113	0.116	**0.114**	0.161	0.147	0.160	**0.156**	0.114	0.116	0.120	**0.117**	**0.129**
D_{10}-Acceleratedly aged for 9 days	0.115	0.120	0.116	**0.117**	0.150	0.141	0.156	**0.149**	0.117	0.112	0.122	**0.117**	**0.128**
D_{11}-Acceleratedly aged for 10 days	0.122	0.106	0.130	**0.119**	0.158	0.144	0.147	**0.150**	0.116	0.118	0.120	**0.118**	**0.129**
D_{12}-Acceleratedly aged for 11 days	0.114	0.116	0.100	**0.110**	0.153	0.156	0.156	**0.155**	0.100	0.099	0.101	**0.100**	**0.122**
D_{13}-Acceleratedly aged for 12 days	0.114	0.115	0.117	**0.115**	0.126	0.136	0.120	**0.127**	0.099	0.097	0.098	**0.098**	**0.114**
D_{14}-Acceleratedly aged for 13 days	0.121	0.114	0.114	**0.116**	0.136	0.139	0.135	**0.137**	0.105	0.097	0.099	**0.100**	**0.118**
D_{15}-Acceleratedly aged for 14 days	0.114	0.117	0.113	**0.115**	0.138	0.132	0.135	**0.135**	0.091	0.090	0.090	**0.090**	**0.113**
D_{16}-Acceleratedly aged for 15 days	0.118	0.119	0.121	**0.119**	0.129	0.135	0.140	**0.135**	0.107	0.108	0.108	**0.108**	**0.121**
D_{17}-Acceleratedly aged for 16 days	0.120	0.118	0.120	**0.119**	0.121	0.129	0.123	**0.124**	0.108	0.109	0.103	**0.107**	**0.117**
D_{18}-Acceleratedly aged for 17 days	0.116	0.115	0.120	**0.117**	0.131	0.129	0.126	**0.129**	0.105	0.036	0.100	**0.080**	**0.109**
D_{19}-Acceleratedly aged for 18 days	0.100	0.114	0.113	**0.109**	0.122	0.132	0.126	**0.127**	0.108	0.000	0.056	**0.055**	**0.097**
D_{20}-Acceleratedly aged for 19 days	0.112	0.108	0.113	**0.111**	0.131	0.131	0.135	**0.132**	0.080	0.000	0.000	**0.027**	**0.090**
D_{21}-Acceleratedly aged for 20 days	0.108	0.100	0.101	**0.103**	0.128	0.128	0.129	**0.128**	0.000	0.000	0.000	**0.000**	**0.077**
Mean	**0.115**	**0.115**	**0.116**	**0.115**	**0.144**	**0.141**	**0.143**	**0.143**	**0.102**	**0.090**	**0.097**	**0.096**	**0.118**
	T1	**0.121**		**T2**	**0.115**		**T3**	**0.118**					

	V	T	D	VT	TD	VD	VTD
SEd	0.0008	0.0008	0.0021	0.0013	0.0036	0.0036	0.0062
CD (P=0.05)	0.0015	0.0015	0.0040	0.0026	0.0070	0.0070	0.0121

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 5: Effect of Accelerated Ageing on Vigour Index of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1-control	3402	3192	3275	**3290**	3386	3207	3301	**3298**	3444	3189	3279	**3304**	**3297**
D_2-Acceleratedly aged for 1 day	3232	2953	3024	**3070**	3209	3013	3098	**3107**	3139	2836	3018	**2998**	**3058**
D_3-Acceleratedly aged for 2 days	3036	2755	2871	**2887**	3102	2808	2945	**2952**	2940	2560	2909	**2803**	**2881**
D_4- Acceleratedly aged for 3 days	2815	2458	2602	**2625**	3004	2637	2749	**2797**	2624	2360	2672	**2552**	**2658**
D_5-Acceleratedly aged for 4 days	2610	2314	2434	**2453**	2847	2543	2674	**2688**	2445	2227	2521	**2398**	**2513**
D_6-Aacceleratedly aged for 5 days	2432	2179	2255	**2289**	2694	2424	2549	**2556**	2284	1987	2220	**2164**	**2336**
D_7-Acceleratedly aged for 6 days	2309	1921	2086	**2105**	2572	2300	2461	**2444**	2132	1813	1968	**1971**	**2174**
D_8-Acceleratedly aged for 7 days	2175	1787	1930	**1964**	2406	2090	2287	**2261**	1901	1689	1852	**1814**	**2013**
D_9-Acceleratedly aged for 8 days	2064	1620	1815	**1833**	2290	1906	2143	**2113**	1721	1417	1674	**1604**	**1850**
D_{10}-Acceleratedly aged for 9 days	1920	1451	1629	**1667**	2173	1772	1943	**1963**	1466	1222	1442	**1377**	**1669**
D_{11}-Acceleratedly aged for 10 days	1799	1330	1480	**1536**	2015	1612	1832	**1820**	1275	1003	1232	**1170**	**1509**
D_{12}-Acceleratedly aged for 11 days	1647	1183	1282	**1371**	1864	1476	1674	**1671**	1103	856	1084	**1014**	**1352**
D_{13}-Acceleratedly aged for 12 days	1565	1030	1188	**1261**	1684	1348	1533	**1522**	933	744	955	**877**	**1220**
D_{14}-Acceleratedly aged for 13 days	1417	939	1054	**1137**	1500	1234	1360	**1365**	777	598	707	**694**	**1065**
D_{15}-Acceleratedly aged for 14 days	1269	803	931	**1001**	1306	1123	1229	**1219**	655	431	543	**543**	**921**
D_{16}-Acceleratedly aged for 15 days	1193	713	792	**899**	1221	1008	1093	**1107**	533	293	392	**406**	**804**
D_{17}-Acceleratedly aged for 16 days	1072	597	710	**793**	1117	915	1015	**1016**	424	145	276	**282**	**697**
D_{18}-Acceleratedly aged for 17 days	924	504	596	**675**	1005	844	872	**907**	237	54	193	**161**	**581**
D_{19}-Acceleratedly aged for 18 days	760	433	486	**560**	889	717	750	**785**	131	0	34	**55**	**467**
D_{20}-Acceleratedly aged for 19 days	534	383	435	**451**	803	594	657	**685**	64	0	0	**21**	**386**
D_{21}-Acceleratedly aged for 20 days	463	278	333	**358**	710	508	544	**587**	0	0	0	**0**	**315**
Mean	**1840**	**1468**	**1581**	**1630**	**1990**	**1718**	**1843**	**1851**	**1439**	**1211**	**1380**	**1343**	**1608**
	T1	**1757**		**T2**	**1465**		**T3**	**1601**					
	V		T		D		VT		TD		VD		VTD
SEd	19.074		19.074		50.466		33.038		87.409		87.409		151.398
CD (P=0.05)	37.465		37.465		99.124		64.892		NS		171.687		NS

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 6: Effect of Accelerated Ageing on Electrical Conductivity of Seed Leachates (μSm^{-1}) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1-control	57.3	59.8	59.1	**58.7**	65.3	67.9	67.8	**67.0**	53.2	55.6	55.2	**54.7**	**60.1**
D_2-Acceleratedly aged for 1 day	59.8	62.4	61.8	**61.3**	68.2	73.4	72.6	**71.4**	56.7	59.2	59.8	**58.6**	**63.8**
D_3-Acceleratedly aged for 2 days	62.1	65.4	64.2	**63.9**	72.6	78.1	76.1	**75.6**	63.4	61.5	64.7	**63.2**	**67.6**
D_4- Acceleratedly aged for 3 days	65.7	68.1	67.0	**66.9**	79.1	81.3	80.6	**80.3**	64.5	65.4	69.4	**66.4**	**71.2**
D_5-Acceleratedly aged for 4 days	68.9	71.6	70.5	**70.3**	83.7	85.6	84.6	**84.6**	66.3	67.5	72.3	**68.7**	**74.6**
D_6-Aacceleratedly aged for 5 days	72.5	76.8	73.8	**74.4**	87.5	89.9	88.1	**88.5**	70.7	72.8	76.4	**73.3**	**78.7**
D_7-Acceleratedly aged for 6 days	77.4	79.9	77.9	**78.4**	92.6	94.7	92.4	**93.2**	75.9	78.5	79.2	**77.9**	**83.2**
D_8-Acceleratedly aged for 7 days	80.6	85.6	81.6	**82.6**	97.3	99.5	96.4	**97.7**	78.1	82.4	82.3	**80.9**	**87.1**
D_9-Acceleratedly aged for 8 days	84.3	89.2	85.4	**86.3**	100.9	103.4	101.2	**101.8**	80.3	87.1	85.1	**84.2**	**90.8**
D_{10}-Acceleratedly aged for 9 days	87.8	93.5	89.0	**90.1**	103.7	108.9	105.4	**106.0**	84.6	92.7	89.9	**89.1**	**95.1**
D_{11}-Acceleratedly aged for 10 days	91.5	97.6	93.1	**94.1**	107.2	112.1	110.8	**110.0**	88.3	96.0	93.4	**92.6**	**98.9**
D_{12}-Acceleratedly aged for 11 days	95.9	101.6	96.2	**97.9**	110.0	115.7	113.8	**113.2**	91.5	99.8	98.0	**96.4**	**102.5**
D_{13}-Acceleratedly aged for 12 days	99.4	105.7	100.3	**101.8**	114.4	118.2	116.1	**116.2**	95.7	103.6	101.5	**100.3**	**106.1**
D_{14}-Acceleratedly aged for 13 days	103.8	109.5	103.4	**105.6**	117.1	122.3	120.3	**119.9**	99.2	108.8	104.8	**104.3**	**109.9**
D_{15}-Acceleratedly aged for 14 days	107.1	113.7	108.2	**109.7**	121.7	127.8	125.6	**125.0**	102.3	113.4	109.2	**108.3**	**114.3**
D_{16}-Acceleratedly aged for 15 days	111.6	117.6	113.4	**114.2**	125.4	131.5	129.5	**128.8**	105.8	118.5	111.5	**111.9**	**118.3**
D_{17}-Acceleratedly aged for 16 days	116.8	122.3	119.9	**119.7**	129.6	137.8	134.1	**133.8**	109.7	121.4	114.7	**115.3**	**122.9**
D_{18}-Acceleratedly aged for 17 days	120.7	126.7	125.2	**124.2**	134.3	142.9	139.9	**139.0**	112.0	125.7	117.1	**118.3**	**127.2**
D_{19}-Acceleratedly aged for 18 days	125.1	130.4	129.7	**128.4**	139.4	149.5	143.5	**144.1**	115.6	135.0	126.4	**125.7**	**132.7**
D_{20}-Acceleratedly aged for 19 days	131.4	135.9	134.3	**133.9**	144.7	156.2	148.7	**149.9**	118.6	141.6	132.1	**130.8**	**138.2**
D_{21}-Acceleratedly aged for 20 days	135.6	140.7	138.4	**138.2**	147.9	162.7	154.6	**155.1**	126.3	149.2	137.8	**137.8**	**143.7**
Mean	**93.1**	**97.8**	**94.9**	**95.3**	**106.8**	**112.4**	**109.6**	**109.6**	**88.5**	**96.9**	**94.3**	**93.3**	**99.4**
	T1	**96.1**		**T2**	**102.4**		**T3**	**99.6**					
	V		T		D		VT		TD		VD		VTD
SEd	0.2559		0.2559		0.6770		0.4432		1.1726		1.1727		2.0311
CD (P=0.05)	0.5032		0.5032		1.3313		0.8715		2.3058		2.3058		3.9937

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 7: Effect of Accelerated Ageing on Dehydrogenase Activity (OD Value/10 Seeds) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1-control	0.842	0.829	0.832	**0.834**	0.934	0.930	0.931	**0.932**	0.820	0.817	0.819	**0.819**	**0.862**
D_2-Acceleratedly aged for 1 day	0.837	0.825	0.825	**0.829**	0.929	0.927	0.928	**0.928**	0.816	0.814	0.815	**0.815**	**0.857**
D_3-Acceleratedly aged for 2 days	0.833	0.821	0.818	**0.824**	0.925	0.923	0.925	**0.924**	0.811	0.809	0.810	**0.810**	**0.853**
D_4- Acceleratedly aged for 3 days	0.829	0.818	0.820	**0.822**	0.921	0.919	0.921	**0.920**	0.807	0.805	0.805	**0.806**	**0.849**
D_5-Acceleratedly aged for 4 days	0.824	0.814	0.817	**0.818**	0.917	0.915	0.918	**0.917**	0.802	0.800	0.801	**0.801**	**0.845**
D_6-Aacceleratedly aged for 5 days	0.820	0.810	0.812	**0.814**	0.913	0.910	0.914	**0.912**	0.797	0.795	0.796	**0.796**	**0.841**
D_7-Acceleratedly aged for 6 days	0.817	0.806	0.807	**0.810**	0.909	0.905	0.911	**0.908**	0.794	0.791	0.793	**0.793**	**0.837**
D_8-Acceleratedly aged for 7 days	0.812	0.800	0.803	**0.805**	0.905	0.901	0.906	**0.904**	0.791	0.787	0.790	**0.789**	**0.833**
D_9-Acceleratedly aged for 8 days	0.808	0.796	0.798	**0.801**	0.901	0.897	0.900	**0.899**	0.788	0.783	0.785	**0.785**	**0.828**
D_{10}-Acceleratedly aged for 9 days	0.803	0.791	0.791	**0.795**	0.897	0.892	0.897	**0.895**	0.783	0.779	0.781	**0.781**	**0.824**
D_{11}-Acceleratedly aged for 10 days	0.799	0.788	0.784	**0.790**	0.893	0.888	0.894	**0.892**	0.779	0.775	0.778	**0.777**	**0.820**
D_{12}-Acceleratedly aged for 11 days	0.795	0.782	0.779	**0.785**	0.889	0.881	0.890	**0.887**	0.774	0.771	0.773	**0.773**	**0.815**
D_{13}-Acceleratedly aged for 12 days	0.791	0.767	0.775	**0.778**	0.884	0.877	0.886	**0.882**	0.770	0.768	0.769	**0.769**	**0.810**
D_{14}-Acceleratedly aged for 13 days	0.786	0.760	0.770	**0.772**	0.880	0.871	0.882	**0.878**	0.767	0.762	0.764	**0.764**	**0.805**
D_{15}-Acceleratedly aged for 14 days	0.779	0.755	0.766	**0.767**	0.875	0.867	0.873	**0.872**	0.762	0.758	0.760	**0.760**	**0.799**
D_{16}-Acceleratedly aged for 15 days	0.774	0.751	0.761	**0.762**	0.871	0.862	0.868	**0.867**	0.758	0.751	0.753	**0.754**	**0.794**
D_{17}-Acceleratedly aged for 16 days	0.768	0.747	0.757	**0.757**	0.868	0.857	0.864	**0.863**	0.754	0.746	0.749	**0.750**	**0.790**
D_{18}-Acceleratedly aged for 17 days	0.762	0.742	0.752	**0.752**	0.863	0.853	0.860	**0.859**	0.750	0.740	0.744	**0.745**	**0.785**
D_{19}-Acceleratedly aged for 18 days	0.759	0.737	0.748	**0.748**	0.858	0.849	0.855	**0.854**	0.746	0.736	0.739	**0.740**	**0.781**
D_{20}-Acceleratedly aged for 19 days	0.754	0.732	0.742	**0.743**	0.855	0.845	0.848	**0.849**	0.741	0.730	0.733	**0.735**	**0.776**
D_{21}-Acceleratedly aged for 20 days	0.750	0.729	0.738	**0.739**	0.851	0.841	0.944	**0.879**	0.734	0.724	0.728	**0.729**	**0.782**
Mean	**0.797**	**0.781**	**0.785**	**0.788**	**0.892**	**0.886**	**0.896**	**0.891**	**0.778**	**0.773**	**0.775**	**0.776**	**0.818**
	T1	**0.823**		**T2**	**0.814**		**T3**	**0.819**					

	V	T	D	VT	TD	VD	VTD
SEd	0.002	0.002	0.006	0.004	0.010	0.010	0.020
CD (P=0.05)	0.004	NS	0.011	0.008	NS	NS	NS

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester

Table 8: Effect of Accelerated Ageing on α- Amylase Activity (mg Maltose/ min.) of Manually and Mechanically Harvested and Threshed Rice Varieties

Treatments	CO51 (V1)				CR1009 Sub 1 (V2)				Improved White Ponni (V3)				Grand Mean
	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	
D_1-control	1.963	1.950	1.954	**1.956**	2.231	2.220	2.225	**2.225**	2.145	2.110	2.129	**2.128**	**2.103**
D_2-Acceleratedly aged for 1 day	1.903	1.891	1.899	**1.898**	2.186	2.153	2.169	**2.169**	2.091	2.046	2.058	**2.065**	**2.044**
D_3-Acceleratedly aged for 2 days	1.866	1.826	1.839	**1.844**	2.093	2.068	2.076	**2.079**	1.995	1.963	1.976	**1.978**	**1.967**
D_4- Acceleratedly aged for 3 days	1.810	1.778	1.788	**1.792**	2.005	1.976	2.000	**1.994**	1.934	1.895	1.912	**1.914**	**1.900**
D_5-Acceleratedly aged for 4 days	1.782	1.708	1.730	**1.740**	1.972	1.934	1.962	**1.956**	1.886	1.821	1.864	**1.857**	**1.851**
D_6-Aacceleratedly aged for 5 days	1.724	1.672	1.692	**1.696**	1.909	1.890	1.895	**1.898**	1.812	1.782	1.803	**1.799**	**1.798**
D_7-Acceleratedly aged for 6 days	1.686	1.634	1.642	**1.654**	1.863	1.835	1.854	**1.851**	1.769	1.711	1.738	**1.739**	**1.748**
D_8-Acceleratedly aged for 7 days	1.611	1.582	1.600	**1.598**	1.808	1.788	1.795	**1.797**	1.706	1.675	1.689	**1.690**	**1.695**
D_9-Acceleratedly aged for 8 days	1.567	1.510	1.561	**1.546**	1.782	1.731	1.756	**1.756**	1.675	1.609	1.631	**1.638**	**1.647**
D_{10}-Acceleratedly aged for 9 days	1.506	1.490	1.507	**1.501**	1.718	1.693	1.699	**1.703**	1.600	1.562	1.589	**1.584**	**1.596**
D_{11}-Acceleratedly aged for 10 days	1.489	1.441	1.489	**1.473**	1.689	1.622	1.645	**1.652**	1.559	1.495	1.522	**1.525**	**1.550**
D_{12}-Acceleratedly aged for 11 days	1.415	1.399	1.436	**1.417**	1.622	1.584	1.597	**1.601**	1.501	1.401	1.489	**1.464**	**1.494**
D_{13}-Acceleratedly aged for 12 days	1.380	1.320	1.399	**1.366**	1.570	1.500	1.523	**1.531**	1.475	1.343	1.406	**1.408**	**1.435**
D_{14}-Acceleratedly aged for 13 days	1.331	1.285	1.351	**1.322**	1.504	1.453	1.469	**1.475**	1.415	1.268	1.353	**1.345**	**1.381**
D_{15}-Acceleratedly aged for 14 days	1.295	1.203	1.301	**1.266**	1.451	1.410	1.425	**1.429**	1.363	1.198	1.271	**1.277**	**1.324**
D_{16}-Acceleratedly aged for 15 days	1.252	1.172	1.256	**1.227**	1.398	1.363	1.382	**1.381**	1.296	1.125	1.193	**1.205**	**1.271**
D_{17}-Acceleratedly aged for 16 days	1.205	1.111	1.195	**1.170**	1.329	1.311	1.322	**1.321**	1.229	1.031	1.101	**1.120**	**1.204**
D_{18}-Acceleratedly aged for 17 days	1.186	1.084	1.109	**1.126**	1.276	1.231	1.245	**1.251**	1.187	0.943	0.991	**1.040**	**1.139**
D_{19}-Acceleratedly aged for 18 days	1.121	1.025	1.067	**1.071**	1.212	1.181	1.198	**1.197**	1.084	0.821	0.910	**0.938**	**1.069**
D_{20}-Acceleratedly aged for 19 days	1.092	0.981	1.011	**1.028**	1.183	1.101	1.125	**1.136**	0.973	0.661	0.868	**0.834**	**0.999**
D_{21}-Acceleratedly aged for 20 days	1.049	0.902	0.976	**0.976**	1.122	1.022	1.049	**1.064**	0.892	0.582	0.754	**0.743**	**0.928**
Mean	**1.487**	**1.427**	**1.467**	**1.460**	**1.663**	**1.622**	**1.639**	**1.641**	**1.552**	**1.431**	**1.488**	**1.490**	**1.531**
	T1	**1.567**		**T2**	**1.493**		**T3**	**1.531**					

	V	T	D	VT	TD	VD	VTD
SEd	0.004	0.004	0.011	0.007	0.020	0.020	0.034
CD (P=0.05)	0.008	0.008	0.022	0.015	0.038	0.038	NS

T_1- Manual harvesting and manual threshing, T_2- Manual harvesting and mechanical threshing and T_3- Combine harvester